Fifth order two derivative Runge-Kutta method with reduced function evaluations for solving IVPs

ABSTRACT

In this paper, the First Same As Last (FSAL) technique is implemented to Two Derivative Runge-Kutta method (TDRK) for the numerical integration of first order Initial Value Problems (IVPs). Using the FSAL property, a four stages fifth algebraic order TDRK method is constructed. Hence, the new method has three effective stages meaning that it has three function evaluations per step. It has two stages less compared with the classical Runge-Kutta for the same order. The stability of the method derived is analyzed. The numerical experiments are carried out to show the accuracy and efficiency of the method by comparing the derived method with other existing Runge-Kutta methods (RK).

Keyword: TDRK method; FSAL technique; IVPs; Explicit methods